

Some of the most notable results of the World Summit on Sustainable Development (WSSD) are the alliances which were developed at the margins of the official negotiation process - in particular the so-called "Type II Partnerships". Driven by emerging market opportunities rather than formal international agreements, these public / private teams are pioneering new

ways of advancing the sustainability agenda.

A remarkable example is the CSP Partnership which was launched in Berlin last June and accepted as a WSSD Type II initiative in September. More than 50 key actors interested in emerging CSP markets were assembled under the leadership of the United Nations Environment Program, IEA SolarPACES, and the German Government. The Partnership is an effort to facilitate CSP uptake in markets that offer most favourable conditions. Ten investment opportunities were identified and made the initial target.

The progress made since June indicates a rapidly growing momentum for CSP. A 50MW investment has been secured by Nevada Power. The new incentive premium for solar thermal electricity in Spain has already launched two 50MW parabolic trough and two 10-15MW solar tower projects. A decision has been made by ESKOM to complete feasibility work for a pioneering commercial solartower application in South Africa in the order of 100MW. Preparatory work for another 100 MW investment is nearing completion in Israel.

The partnership will help to explore viability enhancement opportunities. Cost reductions appear to be feasible through local manufacturing and cooperative procurement of bulk parts. Tapping premium markets for clean energy across country boundaries, e.g. from Mexico to California, seems to be another promising option along with carbon credit sales. The recent launch of the Chicago Climate Exchange (CCX)- highlights that market leaders consider cleaner solutions a key ingredient for future competitiveness. Founding members, such as American Electric Power won't risk to lose their competitive edge because of a lack of government leadership.

The members of the CSP partnership are formulating an integrated market introduction strategy. They will cooperate in launching a CSP Market Initiative, which will be further substantiated at the next partnership meeting in California later this year. If the promises of the CSP partnership are delivered, it could indeed become a model for cooperation between businesses and governments driven by a common leadership vision across country & market boundaries. The United Nations Environment Program is on stand-by to facilitate further progress in this regard.

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Exporting the African sun

Algeria plans strategic CSP development



New Energy Algeria (NEAL) was mandated by the Algerian Government to become signator to the IEA SolarPACES Implementing Agreement on 13 January 2003 at the IEA HQ in Paris. From left to right: Richard Sellers (IEA Head Renewable Energy Unit), Hanns-Joachim Neef (IEA Head Energy Technology Collaboration Division), Michael Geyer (IEA-SolarPACES Executive Secretary), William C. Ramsey (IEA Executive Director), M. Chakib Khelil (Algerian Minister for Energy and Mines), Tewfik Hasni, (President Director General of New Energy Algeria NEAL).

Power cables striding the Mediterranean exporting solar electricity from sun-rich Africa to Europe - futuristic fantasy or near-term reality? As New Energy Algeria (NEAL) takes its place within the IEA SolarPACES Program it seems that Algeria's emerging interest in CSP (concentrating solar power) technology could lead to exciting new developments in the future - including solar exports to Europe.

The initiative which provides the framework for many new investment opportunities is the Algerian Power Market, created following the approval of the Electrical Power Law N° 02-01 on the 5th February 2002. A major objective is to create two interconnected Megaprojects by 2010. First, several power plants with a total capacity output of 2000 MW are in the pipeline. Secondly, two power export cables (Algeria-Spain and Algeria-Italy) with an export power output of 1200 MW are planned.

Meanwhile both the Algerian government and the private sector are aware of Europe's commitment to renewable energy sources, in particular the European Union's aim to have 17% of renewable energy in 2010's energy mix. Internally, Algeria has also taken on its own commitment, with an aim of increasing the solar percentage of its energy mix to 5% by 2010. But beyond this Algeria is looking for a close partnership with the European Union so that Algerian plants may help deliver the green energy needed for Europe to meet its targets.

To bring these plans to reality, and to enhance the participation of the private sector - both local and international - a new company has been created. New Energy Algeria

(NEAL) brings together Sonatrach (the Algerian hydrocarbon producer), Sonelgaz (the Algerian power producer and distributor) and S.I.M. (a privately owned company). ... NEAL is to promote renewables in Algeria and help in:

- cost effective power plant development to promote access to energy to the whole population
- technical, economic and financial support for plant development
- more efficient use of the country's gas reserve

NEAL's interest in CSP is the result of an analysis of national strengths, as Algeria benefits not only from abundant solar radiation but also from an available gas supply. Consequently the concept chosen by the company's shareholders is the Integrated Solar Combined Cycle System (ISCCCS). NEAL's first initiative is to build a new 140 MW ISCCS power plant with 30 MW of solar output. Due to political will, the aim is to have it ready by 2006.

While preparing for near-term supply of solar thermal power, NEAL is also working to develop the demand infrastructure within Algeria. The company is working closely with the legal department of the Ministry of Energy to have a law adopted that will provide proper incentives for renewable energy sources. This will underpin the economic viability of projects involving renewable energy sources. Going further to help promote renewable energy, Algeria has already decided on and is in the process of establishing a green certificate market.

Tewfik Hasni, CEO of NEAL and Algeria's new ExCo member in SolarPACES, is frank about the very strategic interest in renewables, and CSP technology in particular:

"In the long term, renewable energy could be the answer to the energetic needs of the country. The utilization of renewable energies reduces the demand for fossil fuels and increases the exportable gas reserves. Given the long-term aim for CSP plants to be within the cost range of a conventional power plant, the 30% gas savings can be used not only internally but on the exportable energy market."

Hasni is also convinced of the mutual benefits of partnership between Europe and the EU. One issue he raises is the incentives given to European energy producers using CSP technology, suggesting that these should be extended to Algeria's green energy plants.

"Feasibility studies for the two cables linking Algeria to Europe has shown genuine European genuine interest in this initiative, particularly in the access it will provide to much needed renewable energy sources. Even though no Integrated Solar Combined Cycle (ISCC) has been built yet, the management of the NEAL Company is convinced that because of the commitments to green power in both the EU and Algeria, there are no major constraints for the integration of Algerian power to the European grid"

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INDUSTRY *focus*

Solarmundo N.V.

"The Model T of the solar industry" - that is how Miguel Sureda, company President, views the Fresnel-collector based technology which has been developed over a number of years by the Belgian stock corporation Solarmundo N.V. And now, after extensive design work and mechanical testing at a 2,500 m² plant in Liege, Belgium, the company is ready to construct the first commercial-scale pilot plant in a high radiation location.

At the centre of the Solarmundo business case lies the promise of substantial cost reduction of solar electricity. Lievin Ven, co-founder and pioneer of Solarmundo, adheres to the motto "Keep it simple - Make it cheap". Thus the technology is based on flat mirrors - rather than parabolic troughs which are deemed expensive and fault-prone - and they heat the water directly rather than via oil and a heat exchanger. The modular construction and the selection of materials are chosen for series production and for ease of maintenance and repairs.

In the Solarmundo collector, large fields of modular Fresnel reflectors concentrate beam radiation to a stationary receiver at several meters height. This receiver contains a second stage reflector that directs all incoming rays to a tubular absorber. The mirrors themselves, each having a width of 0,5 m, are not completely flat but have a very small curvature which is achieved by mechanical bending. The collector consists of 48 rows of mirror, which leads to a total collector width of 24 m. The second stage concentrator not only enlarges the target for the Fresnel reflectors but additionally insulates the selectively coated absorber tube. The back is covered by opaque insulation and to the front a glass pane reduces convective heat losses. The solar field for a 50 MW solar thermal power

plants will be built up in 12 collector rows each with a length of 1000 m.

The cost reduction potential depends crucially on the balance between investment cost, amortisation of the classical part (sizing of the solar field to the turbine size in order to maximise operation hours), thermal performance and maintenance costs. A team drawn from the Fraunhofer Institute for Solar Energy Systems, PSE GmbH and the German Aerospace Centre (DLR) has endorsed the strategic approach of Solarmundo, assessing that the current design modifications imply a 10% cost reduction in solar electricity - even though the Fresnel collector has about 70% of the thermal performance of a parabolic trough per aperture area. Solarmundo expects that this cost reduction advantages will increase significantly with the optimisation of design parameters

Development work to date has been carried out by a small but highly dedicated R&D and engineering team with a long history in solar thermal technology. Solarmundo is now in the process of establishing alliances with large industrial groups in order to market and implement the technology. The company have recently signed a framework agreement for cooperation with Himin, China, the largest solar thermal company in the world. Meanwhile they are working with a range of industrial and local partners on a number of projects, targeting support from the EU's Sixth Framework Programme. The design team are also addressing a demand for smaller systems for off-grid applications.

See also: www.solarmundo-power.com.

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Linear Fresnel Collectors for Solar Thermal Power Generation

by Hansjörg Lerchenmüller, David Mills, Andreas Häberle

Technology overview

A Linear Fresnel Reflector (LFR) array is a line focus system, similar to parabolic troughs, in which solar radiation is concentrated on an elevated inverted linear absorber using an array of nearly flat reflectors. Recently Linear Fresnel Collectors have attracted increasing attention, and new LFR concepts have been presented.

An LFR has the advantages of low structural support costs for reflectors, fixed fluid joints, a receiver separated from the reflector system, and long focal lengths allowing the use of conventional glass reflectors. The technology is seen to be a lower cost alternative to trough technology for the production of solar steam for power generation.

An LFR can be designed to have similar thermal performance to that of a parabolic trough per aperture area, but recent designs tend to use less expensive reflector materials and absorber components which reduce optical performance. However, this lower performance is outweighed by lower investment and lower operation and maintenance costs. Apart from lower costs, Fresnel collectors have additional advantages, such as simplicity and allowing use of the land below the mirror fields for other economic purposes.

History and present activities

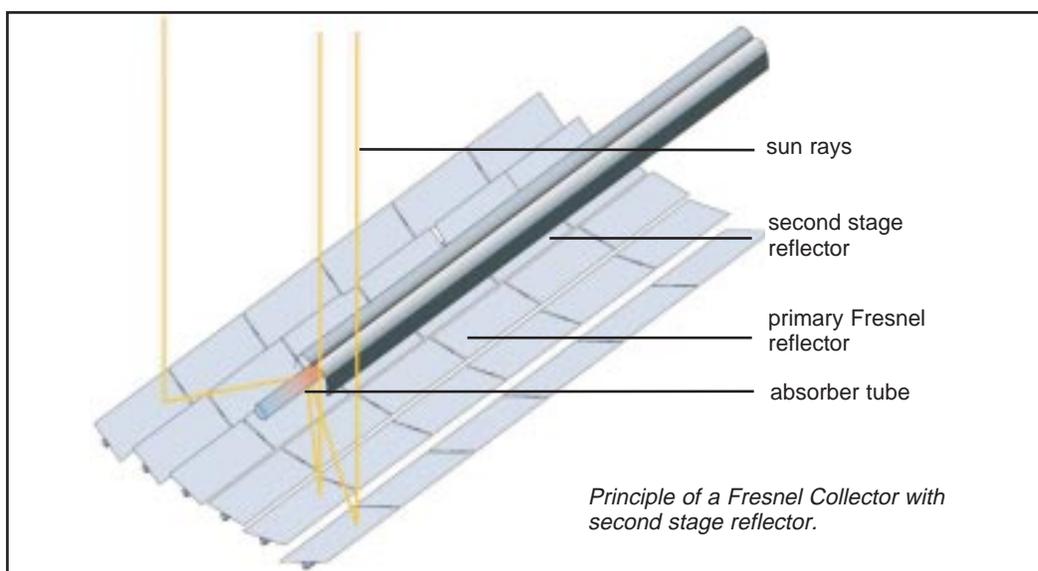
The first to apply this principle in an experimental system for solar collection was Giovanni Francia (1961, 1968) who developed both linear and two-axis tracking Fresnel reflector systems. In 1979, De Canio and colleagues of the FMC Corporation produced a detailed project design study for a 100 MW(e) linear plant using a 1.68 kilometer linear cavity absorber mounted on 61 meter towers. The project ran out of US DoE funding just prior to testing of a cavity absorber section.

Since the 1980's, substantial advances have been made in the areas of spectrally selective absorbers and secondary concentrators, both of which alleviate the requirement for a small primary image size and very high optical concentration. More recently, development of new systems has occurred in Europe and Australia.

Development began on an Australian design at the University of Sydney in 1993 using multiple tower lines with interleaved reflector field. Since this idea reduces the field area, this system is called Compact Linear Fresnel Reflector (CLFR). The concept was developed using

evacuated tube receivers but it now uses a cavity absorber.

In 1999 the Belgian Company Solarmundo erected what today is the largest prototype of a Fresnel collector, with a collector width of 24 m and a reflector area of 2500 m². The system was developed together with Fraunhofer ISE. Solarmundo uses a selectively coated steel absorber tube with a secondary reflector which is allocated above the absorber tube. The secondary reflector not only produces higher concentration, but also protects the tube



from heat losses due to convection.

A third "small" Fresnel collector for process heat applications was developed by DLR in Köln. The modular, so called Fix-Focus system is foreseen for roof installation, having a total width of 6 m and a reflector area of 36 m².

None of the mentioned systems are commercially available yet as they all are in a prototype status. This is why the next step for the Fresnel collector must be a pilot plant to demonstrate the technology in a large scale system under commercial operational conditions. Most convenient and cost-effective would be a plug-in solution of a Fresnel collector connected to an existing power plant. The Australian company Solar Heat and Power is planning a 24000 m² pilot CLFR array for attachment to a coal fired station late in 2003.

IEA Linear Fresnel Reflector Working Group

To intensify exchange of experience, the IEA SolarPACES Task III has formed a working group on Fresnel systems under Dr. David Mills of the University of Sydney.

The working group has three initial areas of activity, organized in the three subgroups: Modeling, Evaluation of Direct Steam Generation and Air Stable Selective Surface Coatings.

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"Solar Eldorado" for Nevada ...

A new 50 MW CSP plant using parabolic trough technology is to be built in Eldorado Valley, Nevada by Duke Solar Energy. The company have signed contracts to supply 50 MW of CSP generated electricity to utility subsidiaries of Sierra Pacific Resources.

Meanwhile, through the U. S. Department of Energy's Concentrating Solar Power Program, contracts are being finalised for The Nevada Solar Dish Power Project. This 1 MW CSP demonstration project is designed to validate the operation of a dish-engine power plant.

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Update on Spanish CSP projects

By the end of 2002 the complete permitting documents for the 50MW parabolic trough plant AndaSol-1 and the second 50MW parabolic trough plant AndaSol-2 had been submitted to the Andalusian Regional Government. Negotiations with EPC-bidders, equity investors and banks are underway. Meanwhile, the 10MW solar tower project PS10 of the Abengoa Group has already received all permits from the Andalusian Regional Government. The equity has been secured and negotiations with banks are being finalized. Both AndaSol-1 and PS-10 have received a 5 Mio Euro support from the European Union within the 5th Framework Program.

GEF project update

In India, three prequalified consortia are preparing bids to construct the 140 MWe ISCC Power Plant planned for Mathania in Rajasthan. Bids for the plant are due on 6 May 2003.

In Egypt, the New & Renewable Energy Authority (NREA) and the Egyptian Energy Authority have selected Fichtner Solar to prepare and evaluate the Request for Proposals (RFP) for the 120-140 MWe Integrated Solar Combined Cycle (ISCC) Plant planned for Kuraymat.

Meanwhile in Morocco the Office Nationale d'Electricité (ONE) of Morocco is reviewing the business structure options for a 220 MWe plant to be located in the vicinity of Ain Beni Mathar, about 40 km west of the border with Algeria and 150 km inland.

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EuroTrough testloop to go ahead in California

A full loop with 4360m² of the new EuroTrough parabolic trough collectors is being erected now (February - March

2003) at SEGS V in Kramer Junction by Solar Millennium AG, Flabeg Solar International GmbH, Schlaich Bergemann und Partner GmbH in close cooperation with the Kramer Junction Operating Company. This loop will demonstrate the performance advantages of the 100m and 150m versions of the EuroTrough in commercial operation with co-sponsorship of the German Ministry for Environment (BMU).

SolarPACES Symposium

September 2002 saw some 230 participants from 24 countries gather in Switzerland for the biennial SolarPACES Symposium, where a notable highlight was the Keynote presentation by Nobel laureate Prof. Carlo Rubbia. Proceedings of the Symposium include 92 peer-reviewed papers.

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EC 6th R&D Framework Programme

On December 17th 2002 the first call for proposals of the European Commission's 6th R&D Framework Programme was published. Support for solar thermal technologies is available within "Sustainable Energy Systems", part of thematic priority 6. The first deadline for "Sustainable Energy Systems" is March 18th 2003 with a total indicative budget of 280 million Euro.

For further info see: <http://fp6.cordis.lu/fp6/calls.cfm>

CSP Global Market Initiative to be launched

An international executive conference to be held in California in May 2003 will launch a 5,000 MW Global Market Initiative (GMI) for CSP, based on potential markets in the southwest US and in other countries with ideal conditions. Sponsored by Solar Energy Industries Association (SEIA), International Energy Agency (IEA), California Energy Commission (CEC), US Department of Energy (DOE), Global Environment Facility (GEF) and the United Nations Environmental Programme (UNEP), the meeting builds on preliminary work carried out at the Berlin Conference in 2002.

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New ExCo member from Egypt

Following the retirement of Eng. Sherif Aboulnasr, Eng. Hosny El-Kholy has joined the SolarPACES Executive Committee. Mr. El-Kholy became the Executive Chairman of Egypt's New and Renewable Energy Authority (NREA) in December 2002.



SolarPACES NEWS

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SolarPACES is a program of the International Energy Agency focusing on concentrating solar power and solar chemical energy systems. As of February 2003 the participating members are:

Algeria, Australia, Brazil, Egypt, European Commission, France, Germany, Israel, Mexico, Russia, South Africa, Spain, Switzerland, United Kingdom, United States.

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